

Clayton found on the day that the kite observations were made, on which he based his calculation, that the observed rate of precipitation was only one-tenth of the computed rate. He concluded that much of the condensed moisture was reabsorbed by the unsaturated lower layers of the atmosphere.

While this might be true with a saturation temperature of 34.8° F., such as he observed, since the total amount of vapor present in the air would necessarily be small, as shown by Table 3, we can not suppose that any such proportion of the moisture condensed under conditions such as we have here considered would be so reabsorbed.

Undoubtedly there are many considerations that will contribute to reduce the precipitation to a rate much below that of condensation. Nevertheless, Professor Bigelow's tables for computing the adiabatic changes under various surface conditions have opened up to us a profitable field for study.

RAINFALL ON THE ISLAND OF ST. KITTS, W. I.

By W. H. ALEXANDER, Observer, Weather Bureau, dated Nov. 19, 1900.

This paper is the fulfilment of a purpose expressed in an article on the Climatology of St. Kitts, published in the REVIEW, Annual Summary, for 1899, and for obvious reasons the two should be considered together, the one being supplementary to the other.

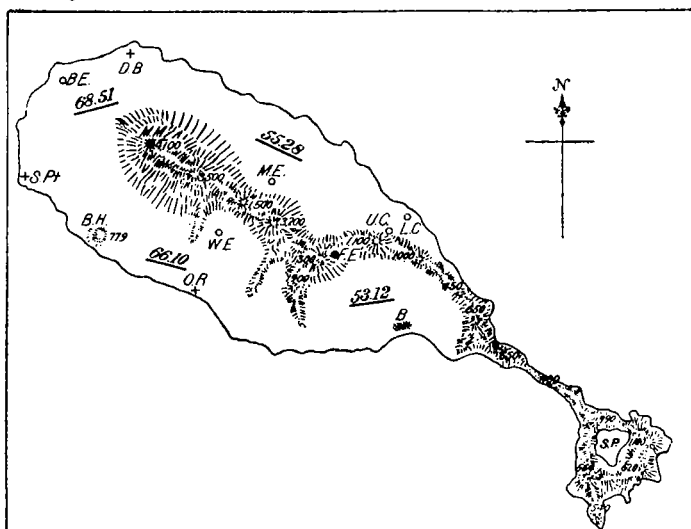


FIG. 2.—Island of St. Kitts, W. I., latitude 17° 18' north, longitude 62° 48' west.

Explanatory.

B. Basseterre, the capital and chief town; location of U. S. Weather Bureau. O. R. Old Roads, a small village. B. H. Brimstone Hill, at one time a celebrated fortress. S. Pt. Sandy Point, a small village. D. B. Dieppe Bay, a small village. M. M. Mount Misery, an extinct volcano, about 4,100 feet high. S. P. Salt Pond. W. E. Wingfield Estate. M. E. Molyneux Estate. L. C. Lower Canada. U. C. Upper Canada. F. E. Fountain Estate. B. E. Brotherson Estate.

Attention is first invited to the careful consideration of the accompanying map of St. Kitts, which together with the descriptive matter found in the article in the Annual Summary, ought to give the reader a very clear idea of the contour and physical features of the island. Very great pains have been taken in the construction of this map, and it is believed to be entirely trustworthy for all purposes, being simply a reduced form of a map issued by the Admiralty of the English Government. Only such places as are referred to elsewhere in the text, and those of peculiar interest, have been noted on the map, the main purpose being to render more intelligible the divisions made of the island for this discussion. The guiding principle in the division was to group those estates similarly situated with reference to the hills and mountains, and so, if possible, arrive at some estimate of the local influences which obtain on the island with

regard to rainfall. We make four divisions as follows, viz:

1. *The north end.*—This includes all that portion of the island to the north of a line drawn, say, from Sandy Point (S. Pt.) in a nearly northeasterly direction, crossing the foot hills of the mountains and then to the sea. Roughly speaking, this embraces about twenty-eight per cent of the cultivated portion of the island. The rainfall in this district is, perhaps, the least influenced by the elevated portions of the island, or if at all, certainly very differently affected thereby. The average annual rainfall on this area, as determined by the records of the thirteen stations covering a number of years, is 68.51 inches, as indicated on the map, and also in Table 1. The greatest annual rainfall on record, 114.68 inches, occurred at Brotherson's estate, within this division, in 1898.

2. *The east side.*—This division embraces all the estates on the windward side of the island, and represents about twenty-seven per cent of all the cultivated portion of the island. The influence of the mountains upon the rainfall of this district is attested by a marked decrease of more than 13 inches in the yearly average from that of the north end, being only 55.28 inches. This decrease may be partly accounted for by a phenomenon frequently noticed, especially on days when strong convectional currents are present—the passing of the clouds around instead of over the mountains. For instance, a large cumulo-nimbus cloud may be seen approaching from the east, but as it nears the land it will be seen to change its course and pass either around the mountains or perhaps will be drawn over the depression in the mountain range of the main body of the island. As a result, we find a very heavy rainfall on both sides of this depression, as shown by the records of the two estates, Molyneux and Wingfield, given in the table. The clouds sometimes divide, one portion going north or south of the mountains, and the other over the depression just mentioned.

3. *The south end.*—This division includes the picturesque and fertile Valley of Basseterre, and is encircled on three sides by hills and mountains of heights varying from 400 to 1,300 feet, as shown on the map; it contains about twenty-nine per cent of the cultivated land of the island, and has the smallest average rainfall of the four districts, it being only 53.12 inches, or more than two inches below the east side and 15 inches below the north end.

4. *The west side.*—This division contains only about 16 per cent of the cultivated lands of the island and is situated on the leeward side of the great mountain range, which runs ridge-pole like through the central part of the main body of the island. The average for this district—66.10 inches—is not far below that of the north end. Perhaps the most interesting point in this district as regards our present discussion is that of the Wingfield estate mentioned above.

Taking the island as a whole the records seem to indicate an annual average of 59.25 inches, which is an appreciable increase upon the average given in the discussion in the Annual Summary for 1899, namely, 51.66 inches; which, however, was the average for Basseterre alone. The greatest downpour at any one time was that known as the flood of 1880, an account of which may be found on page 196 of the REVIEW for January, 1899. In addition to what has been said I will add a note found in Mr. Evelyn's old records made at the time of the flood. It reads:

Supposed that 36 inches fell during the time from 12 o'clock (noon) to 3 a. m. of 12th. Town flooded; immense damage to houses; 230 lives lost and missing.

The month of March, 1891, is the driest month on record. The average for the island was only 0.16 inch, whereas the normal amount for that month is about 1.57 inches. Attention is called to the fact that there is a difference of only 0.08 inch in the annual mean at Molyneux and Wingfield estates.

The former is on the windward side of the mountains about 700 feet above the sea and the latter is on the leeward side about 175 feet above the sea. Then again the records of Upper and Lower Canada are worthy of note. Here we have two estates similarly situated, except that one is about 400 feet higher than the other. As a result of this difference in elevation we see a marked and very uniform difference in the monthly and yearly means. See Table 2.

In the year 1899 the prevailing wind for each month in the year was from the east except for December, which was north-east. Or, to state it in another way, the wind was from the east during 54 per cent of the time and from the northeast during 32 per cent of the time. The prevailing winds, together with such other facts as may be gained from this and preceding papers on this subject, prepare the reader for an intelligent appreciation of the agencies which operate in producing and modifying the rainfall on the Island of St. Kitts.

The gages used at these stations were imported from England and appear to be well and scientifically constructed, there being a fixed and uniform ratio between the diameter of the funnel and the diameter of the graduated tube. The measurements are made with great care and regularity, the day, as a rule, is counted from 6 a. m. to 6 a. m., local time.

It only remains to be said with reference to Table 4 that it is the result of an effort to secure some mountain observations and is almost self explanatory. Fountain estate is about 850 feet above sea level and the only available place for such work. The owner, Miss Marshall, kindly consented to do the work if provided with instruments. Accordingly she was equipped with maximum, minimum, and dry thermometers, and these were duly installed on February 14, 1900, and the first observations were made on the following day. The observations were taken on seventy-fifth meridian time and were continued up to and including May 17, 1900. Only two observations were missed during the time. Unfortunately the maximum thermometer was broken at the end of the first week, so that no note is made of the readings of the maximum thermometer except for the one week. The corresponding data on record at this office for precisely the same time are also inserted in the table for the sake of comparison.

The data in Table 5 are fully explained in the foot note, and it only remains to say that the work was done at my request and by responsible parties.

TABLE 1.—*Monthly and yearly means of rainfall within each of the four divisions into which the island is divided.*

Divisions.	No. stations	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	For year.
North end	13	3.35	2.42	1.92	3.63	8.16	4.89	6.41	7.32	8.47	7.39	7.87	5.87	68.51
East side	15	3.00	1.96	1.33	3.12	6.45	3.40	5.01	6.98	7.46	7.31	6.94	4.49	55.28
South end	11	2.95	2.27	1.12	2.08	5.53	3.08	4.59	6.26	6.96	4.82	4.92	4.99	53.12
West side	7	4.18	2.53	1.91	2.30	4.41	3.64	6.07	7.37	6.84	6.66	6.45	5.50	66.10

NOTE.—The first column shows the number of stations upon whose records the means are based.

TABLE 2.—*Monthly and annual means for certain estates which for local causes present interesting points.*

Estates.	No. years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	For year.
Brotherson's...	5	4.33	2.69	2.58	4.28	7.42	7.26	8.30	7.86	10.48	7.94	13.52	5.76	85.21
Molyneux	5	3.31	2.29	2.10	4.52	7.12	5.10	5.88	7.30	8.80	8.77	10.21	5.59	71.62
Lower Canada ..	18	2.47	1.57	1.65	2.56	4.31	3.73	3.94	5.76	5.96	4.91	5.05	3.04	45.01
Upper Canada ..	18	3.04	1.93	1.94	2.92	4.98	4.51	4.87	6.24	6.32	5.65	5.81	3.59	52.93
Wingfield	21	5.41	4.85	3.79	3.75	4.99	5.15	5.94	8.06	7.45	8.30	7.09	7.14	71.54
Basseterre	44	3.66	1.89	2.07	3.32	4.18	4.00	4.46	5.67	6.45	6.54	5.36	3.76	51.38

NOTE.—The number of years record involved is shown in first column. These estates are located on the accompanying map, fig. 2.

TABLE 3.—*A comparative study of the rainfall on four of the Leeward Islands for the year 1895.*

Islands.	No. stations	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	For year.
Montserrat.....	1	4.40	1.29	3.13	1.51	5.61	5.77	8.22	12.33	11.20	6.77	10.40	2.57	73.20
Antigua.....	60	2.30	0.51	1.45	2.30	7.94	1.57	3.65	6.46	7.41	5.13	5.08	8.83	52.91
Nevis.....	13	3.56	1.39	2.12	1.85	7.67	3.97	3.09	7.49	7.31	5.95	5.00	4.52	53.32
St. Kitts.....	35	2.66	1.41	1.13	2.00	9.86	2.66	4.82	7.54	8.48	4.94	3.14	6.41	56.61

NOTE.—The number of stations on each island reporting is shown in first column.

TABLE 4.—*Results of simultaneous observations at two stations.*

[The location of each station is shown on the map, fig. 2.]

FOUNTAIN ESTATE, ST. KITTS.

[Elevation about 850 feet above sea level.]

Months.	Temperature.						Precipitation.	
	Monthly mean.		Highest (obs.).	Date.	Lowest.	Date.	Amount.	No. days with .01 inch or more.
	8 a. m.	Minimum.						
1900.	°	°	°		°		Inches.	
February	75.4	67.8	80	26	65	15	0.79	5
March	74.7	67.4	82	30	64	23	2.12	15
April	77.0*	68.7*	85	1, 24	64	7	4.98	20
May	79.1*	71.2*	84	12	70	5	1.28	11

UNITED STATES WEATHER BUREAU, ST. KITTS.

[Elevation 29 feet above sea level.]

February	78.2	73.5	80	26	70	28	0.15	2
March	77.4	72.7	83	30	69	12	1.04	5
April	78.2	73.0	86	28	68	19	2.64	18
May	80.8	75.2	82	3	68	14	0.42	7

*One observation missing.

TABLE 5.—*Results of meteorological observations.*

Time.	Estimated elevation.	Barometer (actual).	Thermometer.		Relative humidity.	Remarks.
			Dry.	Wet.		
	Feet.	Inches.	°	°		
8:30 a. m.	1,000	29.02	74.2	69.5	79	Open pasture; sun shining.
9:00 a. m.	1,500	28.52	68.0	67.0	95	Under a tree; cloudy.
9:30 a. m.	2,000	27.86	65.0	In the forest; sun shining.
10:30 a. m.	2,740	27.17	63.8	63.0	97	Lip of crater; low forest; overcast.
11:00 a. m.	2,150	27.75	65.0	65.0	100	Open land; bottom of crater; rained immediately after.
1:05 p. m.	3,100	26.75	Lip of crater under the peak.

This table presents the results of meteorological observations made by Drs. Christian and Edmond Braush and Mr. George King on April 23, 1900, while exploring the crater of Mount Misery. The barometer used was an aneroid and was set the day before to read with the barograph at this station. The thermometers were supplied from this office.

NOTES ON LOCAL WHIRLWINDS IN NEW BRUNSWICK.

By SAMUEL W. KAIN.

The province of New Brunswick is very rarely visited by violent storms, and the undesirable phenomena due to atmospheric disturbances have been recorded only at long intervals.

The tornadoes and cloudbursts which are reported so often from the west and south are happily almost unknown here.

Still it must not be forgotten that we have had such storms. On August 17, 1898, a tornado of considerable violence swept over the parish of Dumfries, York County, and in the United States WEATHER REVIEW for March, 1898, I have described a cloudburst observed near Sussex on August 1, 1897.

It may therefore be of some interest to briefly describe a small whirlwind observed at 4 p. m. on the 24th of May, 1900, by Mr. Keith A. Barber. While Mr. Barber was standing by the side of a pool of water about six miles from Clarendon